ABB Ability™ Smart Sensor
Motors that let you know when it's time for a service
ABB Ability™ Smart Sensor

The Executive Summary

- ABB Ability™ Smart Sensor is like a fitness wristband for electric motors
- You fit it easily to the surface of a motor, and get operational data and health info of the motor
- Maintenance and operation can be optimised in a way that was not possible before
- The savings in downtime, reliability and energy consumption can be huge
- Payback time expected to be less than one year in most cases
- With IoT-technology the sensor does things at a low cost that was unthinkable a few years ago
The Internet of Things (IoT)

Global trend – Fourth Industrial Revolution

Industry 1.0 – 1712
First practical steam engine

Industry 2.0 – 1870
First elevated conveyor belts

Industry 3.0 – 1969
Electronics / software based control

Industry 4.0 – today and tomorrow
Internet of …

People

Things

Services

ABB leads proactively with new connected offerings
Will motors be included in the IoT?

- If a large number of motors delivered status information...
- If monitoring equipment were affordable and easy to install...
- If competent data analysis with a large volume of information were readily available...

...then service engineers could provide advanced plant optimization at affordable costs.

...and plant operators could save operating costs and increase productivity.
Plant owners can boost their results with better monitoring and maintenance for their LV motors

Most LV motors are not monitored, and are only maintained when something goes wrong.

In most cases, sophisticated monitoring of LV motors does not make economic sense today:

- A significant infrastructure is required, which typically costs more than the motors themselves.
- Specialist personnel are needed to install and maintain the monitoring equipment.
- Without correctly installed infrastructure, the maintenance team does not have sufficient data to carry out optimizations.
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Monitoring and maintenance of LV motors today

Maintenance teams face several limitations

- Maintenance is fragmented and unconnected, with a separate team for each site (or at most one team covering a few sites)
- The teams do not have the motor manufacturer’s know-how and expertise
- The teams cannot get contracts to service a significant part of the installed population due to the large number of motors
Condition monitoring for LV motors
Millions of motors can be monitored

**ABB Ability™ Smart Sensor system**

ABB Ability™ Smart Sensor is attached directly to the motor. This multi-sensor system with a wireless communication interface collects and sends precise measurements.

**Automated and user-friendly**

Data is made available on mobile devices and PCs. The plant operator can access the analyzed data and measured values, and optimize maintenance, prevent unplanned stops and save costs.
### ABB Ability™ Smart Sensor

#### Benefits

<table>
<thead>
<tr>
<th>Easy, smart and cost-effective solution for millions of motors</th>
<th>Paving the way for new business models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced maintenance costs</td>
<td>Potential new models could be:</td>
</tr>
<tr>
<td>Optimized utilization and thus energy consumption of motors</td>
<td>Plants contract with a service provider who provides sensors and monitoring</td>
</tr>
<tr>
<td>Optimized operational planning</td>
<td>Service provider calculates potential energy savings and optimizes the maintenance schedule</td>
</tr>
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### ABB Ability™ Smart Sensor

Three elements: Hardware, Apps, Web portal

<table>
<thead>
<tr>
<th><strong>Hardware kit (for field upgrade)</strong></th>
<th><strong>Smartphone apps</strong></th>
<th><strong>Web portal, packages</strong></th>
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<tbody>
<tr>
<td>Sensor</td>
<td>Sensor / motor registration</td>
<td>Maintenance package:</td>
</tr>
<tr>
<td>Bracket</td>
<td>Health parameters</td>
<td>- Health parameters in the app</td>
</tr>
<tr>
<td>Sensor mount</td>
<td>Operational parameters</td>
<td>- Operational parameters in the app</td>
</tr>
<tr>
<td>Adhesive putty</td>
<td></td>
<td>- User registration</td>
</tr>
<tr>
<td>Three screws</td>
<td></td>
<td>- Support</td>
</tr>
<tr>
<td>Quick Start Guide</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analyst package as above, plus:
- Health parameters in the web portal
- Operational parameters in the web portal
- Trending
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The packages

**“Maintenance” Package**
- Sensor mount: one size only
- Data consumption via smart device only

**“Analyst” Package**
- Sensor mount: one size only
- Data consumption via smart device and trends on web portal

**“Startup” Package**
- Sensor mounts: all available
- Data consumption via smart device and trends on web portal

Customer or ABB engineer
Customer portal
**ABB Ability™ Smart Sensor**

System layout

- **ABB Services**
  - Cloud-based ABB Ability™ platform
  - Proprietary, patented ABB Software User portal

- **Customer Site**
  - Gateway (future release)
  - Sensors on motors (first release)
  - Customer or ABB engineer

- **Customer portal**
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How can this solution help to save money?

This solution can help to ...

Reduce downtime by as much as 70%
- Service or replace motors before they break down
- Shift unplanned maintenance to planned outages

Extend lifetime by up to 30%
- Avoid motor failures by timely servicing
- Prevent secondary damage by avoiding breakdowns

Increase energy efficiency by around 10%
- Create better loading profiles based on energy consumption patterns
- Rationalize the installed base (replace less efficient and over-dimensioned motors)
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Hardware

- **Range:**
  - theoretical max: > 100 m
  - realistic: ~ 50 m
  - industrial environment: < 25 m

- **MEMS Multi-Sensor System** inside

- **Built-in batteries** (Not user exchangeable.)

- Firmware with FOTA (Firmware Over-The-Air, i.e. updates via smartphone)

- No electrical wiring required / possible.

- **UNF 1/4"- 28** as mechanical interface. “Future proof” for possible upcoming Smart Sensor of different design.

- The sensor mount is **permanently installed** on the motor using adhesive putty (Henkel Loctite 3463).

  6 sizes of sensor mount are available initially.

Initial certification logos:
CE, Bluetooth, WEEE “Wheelie”
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Upgrade kit

Hardware kit (for field upgrade)

- Sensor
- Bracket
- Sensor mount
- Adhesive putty
- Three screws
- Quick Start Guide

Release labelling with certification logos

[Abb image with certification logos]

abb.com/smartsensor
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Future release dashboard high level view with drill down to parameter detail for specific motor
### ABB Ability™ Smart Sensor
Evolution - LV motors covered, parameters measured

<table>
<thead>
<tr>
<th>Parameters supported</th>
<th>Problem or operating characteristic</th>
<th>DOL or Softstarter, S1 operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Vibration</td>
<td>Unbalance, loose mass, coupling management, load effects, soft foot, etc.</td>
<td>P</td>
</tr>
<tr>
<td>Axial Vibration</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Radial Vibration</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Tangential Vibration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bearing Condition</td>
<td>Bearing damage</td>
<td>P</td>
</tr>
<tr>
<td>Cooling Condition</td>
<td>Overheating due to blocking of air flow</td>
<td>*</td>
</tr>
<tr>
<td>Airgap Eccentricity</td>
<td>Soft foot/ bent shaft/ thermal bow</td>
<td>*</td>
</tr>
<tr>
<td>Rotor Winding Health</td>
<td>Cracked rotor bar/ ring detection</td>
<td>*</td>
</tr>
<tr>
<td>Skin Temperature / °C or °F</td>
<td>Operating information</td>
<td>P</td>
</tr>
<tr>
<td>Energy Consumption / kWh</td>
<td>Process change, replacement decision</td>
<td>*</td>
</tr>
<tr>
<td>Operating Hours / h</td>
<td>Operating information</td>
<td>P</td>
</tr>
<tr>
<td>Operating Power/ kWand Loading / %</td>
<td>Process change, reliability (overloading)</td>
<td>*</td>
</tr>
<tr>
<td>Number of Starts</td>
<td>Operating information</td>
<td>P</td>
</tr>
<tr>
<td>Speed / rpm</td>
<td>Operating information</td>
<td>P</td>
</tr>
<tr>
<td>Motor Supply Frequency / Hz</td>
<td>Operating information</td>
<td>P</td>
</tr>
<tr>
<td>Notifications</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Regreasing</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>Battery indicator</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>IP 66</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>CE</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>FCC, UL, C-UL</td>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Class 1, Div. 2 / ATEX (Ex ia T4 -40 °C/ +85 °C)</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

**Vibration parameters**

**Health parameters**

**Operating parameters**

**Maintenance Advice**

**Sensor unit Status**

**Certifications**

First release - P
Future release - □

Covered motor types (first release):
- Standard 3-phase LV induction motors
- Cast iron or Cast aluminium, finned frame, TEFC
- 140-449 NEMA, 160-450 IEC frames

DOL intermittent and VFD operation available in future release (software update).
Failure statistics

Motors in petrochemical industry

**Motors below 2 MW**

Motors below 2 MW commonly use anti-friction bearings, which are more likely to fail.

**Motors above 2 MW**

Motors above 2 MW often use sleeve bearings, which are less likely to fail.